Optimal Dynamic Taxes

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Classical question in public finance

How to efficiently redistribute resources among individuals and provide social insurance?

Why dynamic?

- Starting point - static analysis pioneered by Mirrlees (1971)
- Many important questions are inherently dynamic
  - How should capital income, labor income, consumption be taxed?
  - How should social security be designed?
  - Taxation of bequests? Subsidies to education?
- Integrated dynamic approach is necessary

New Dynamic Public Finance

- Over past 10 years significant advances have been made in understanding dynamic issues
  - Albanesi, Ales, Farhi, Fukushima, Golosov, Grochulski, Hosseini, Kapicka, Kocherlakota, Maziero, Troshkin, Tsyvinski, Sleet, Werning, Yeltekin, Zhang
- Typical assumptions
  - rich dynamic structure
  - uncertainty about future shocks
  - savings decisions

Main issues

- Only partial characterizations available in general
  - sign of the savings distortion
  - progressivity of capital taxes
  - optimality of bequest taxes
- Outstanding issues
  - policy can look very complicated and unnatural
  - which complications are important?
  - lacks connection to data and policy recommendations
- This talk
  - policy implications of dynamic public finance

Main policy lessons

- Taxes and transfers should depend on past labor income choices
  - Consolidated Income Account can track summary of past earning and condition transfers and taxes on it
- Labor distortions and marginal taxes are lower early in life, increase over time
- Redistribution to low ability agents increases over their lifetime

Static model

- Preferences $U(c, l)$
- Types θ with distribution $F(\theta)$
- Type θ who supplies l units of effort produces $y = \theta l$ units of output
  - θ and l unobservable
  - y and c observable
- Aggregate feasibility

$$\int c(\theta)\, dF(\theta) \leq \int \theta l(\theta)\, dF(\theta)$$

Social objective

- Government chooses taxes $T(y)$ to maximize social welfare G
- Solution is equivalent to a mechanism design problem
  - agents report their types to fictitious social planner
  - planner allocates $c(\theta)$ and $y(\theta)$ so that no one wants to lie
- Back out optimal taxes $T(y)$ from mechanism design problem

Planners problem

Optimal allocation solves

$$\min_{\{c(\theta),y(\theta)\}} \int (c(\theta) - y(\theta))\, dF(\theta)$$

s.t.

$$\begin{aligned} U(c(\theta), y(\theta)/\theta) &\geq U\left(c\left(\theta'\right), y\left(\theta'\right)/\theta\right) \text{ for all } \theta, \theta' \\ w_0 &= \int G(U(c(\theta), y(\theta)/\theta))\, dF(\theta) \end{aligned}$$

Solution

- Diamond (1998) - assume quasilinear preferences (no income effects)
- Optimal taxes:

$$\frac{T'(\theta)}{1-T'(\theta)} = \gamma(\theta)\left(\frac{1-F(\theta)}{\theta f(\theta)}\right)\left(\int_{\theta}^{\infty}\left(1-\frac{G'(U)\,U(x)}{p}\right)\frac{dF(x)}{1-F(\theta)}\right)$$

- Three key parameters:
  - elasticity of labor supply $\gamma(\theta)$
  - distribution of types $F(\theta)$
  - desirable degree of redistribution G

Intuition

- High labor elasticity $\Longrightarrow$ taxes more distortionary $\Longrightarrow$ low marginal taxes
- Marginal tax on type θ needed to redistribute to θ from $1 - F(\theta)$ more productive types
  - large $1 - F(\theta) \Longrightarrow$ high marginal taxes
  - large $\theta f(\theta) \Longrightarrow$ low marginal taxes
  - tail ratio $(1 - F(\theta)) / \theta f(\theta)$ is the key
- More redistribution $\Longrightarrow$ more curvature on $G \Longrightarrow$ high marginal taxes

Mirrleesian taxes and actual tax code

- In theoretical framework consider integrated system of taxes *and* all transfers
- Actual tax systems often consist of statutory taxes and a variety of welfare programs
  - labor distortions is a sum of the distortions from all of those programs
- This calls for integrated tax/social security system
  - various social insurance programs should be integrated in one tax code

Dynamic approach

- Individuals live for $T \leq \infty$ periods
- θ_t evolves stochastically over time
- Feasibility

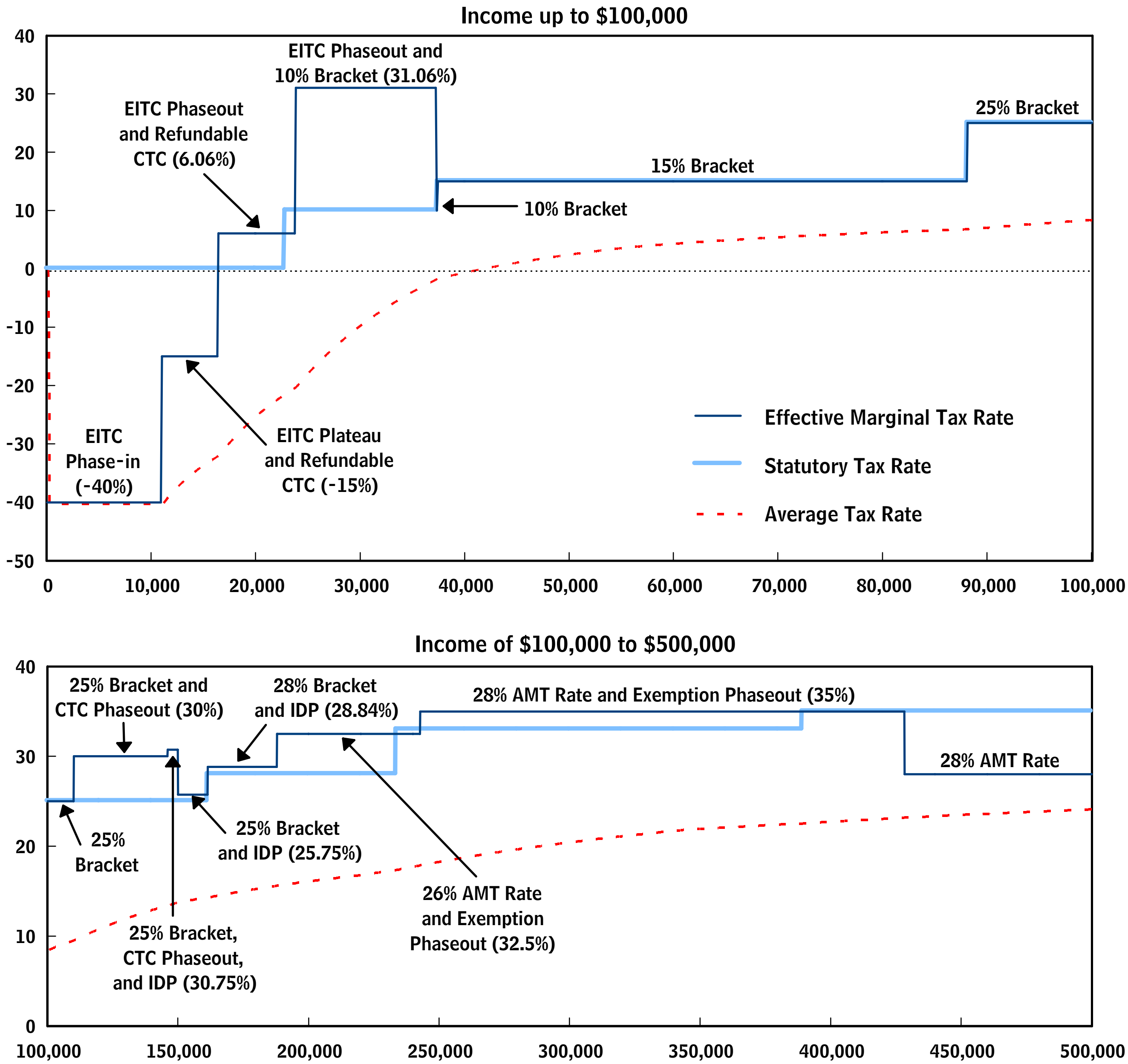
$$\int c_t(\theta_t)\, dF_t(\theta) + K_{t+1} \leq H\left(K_t, \int y_t(\theta_t)\, dF_t(\theta)\right) + (1-\delta) K_t$$

- Incentive constraint is dynamic, your report today affects your lifetime expected utility
- Extensions: human capital, shocks to investments, etc.

Figure 4.

Effective Marginal Federal Income Tax Rates for a Married Couple with Two Children in 2005

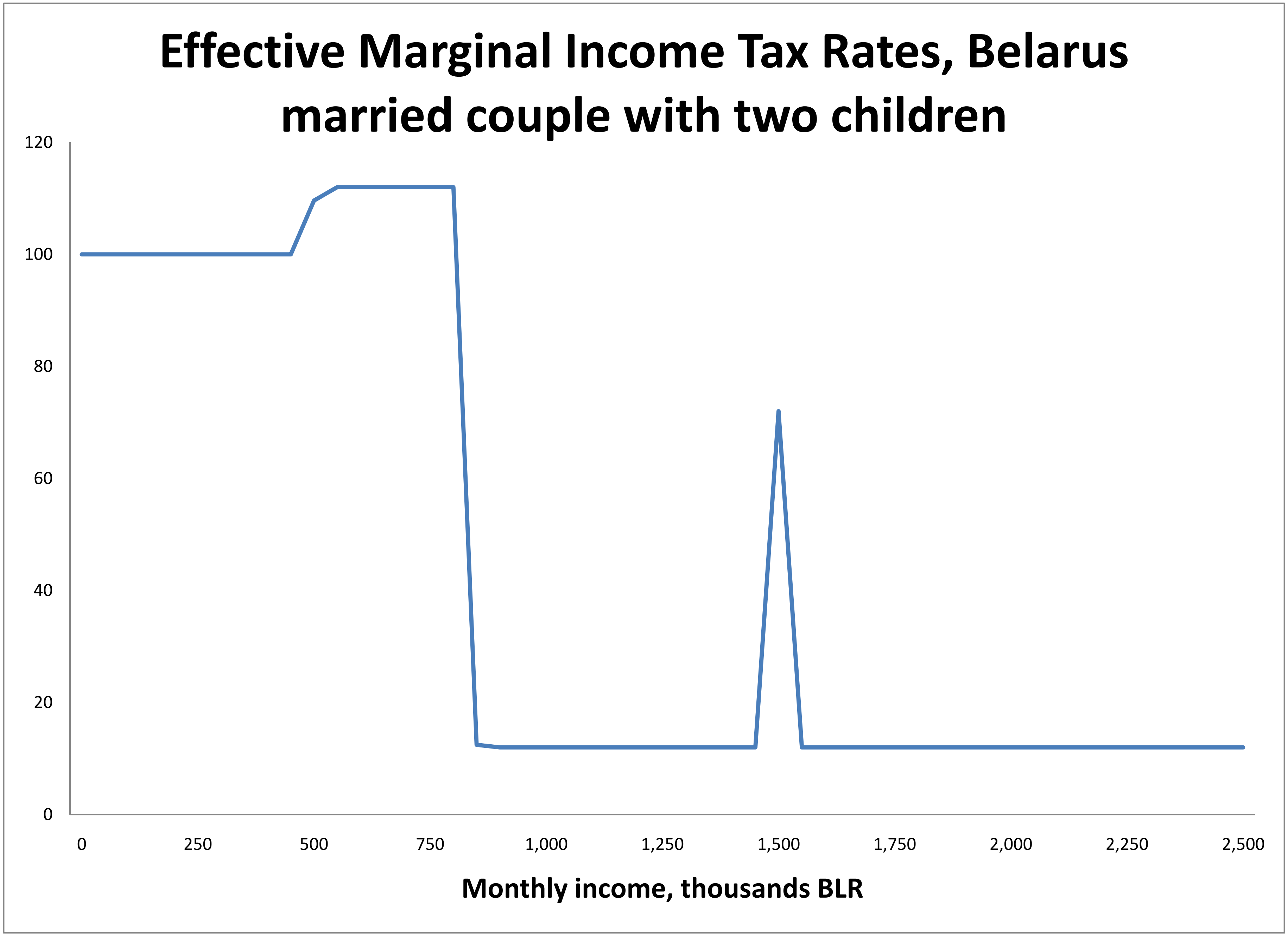
(Percent)



Source: Congressional Budget Office.

Notes: This example assumes that the taxpayers are a married couple filing jointly with two dependents. All of the couple's income is from wages earned by one spouse. The couple has itemized deductions worth 18 percent of income and claims the greater of those deductions or the standard deduction. (Forty percent of the itemized deductions are assumed to be state and local taxes, and the rest are charitable contributions and mortgage interest.)

EITC = earned income tax credit; CTC = child tax credit; IDP = itemized-deduction phaseout; AMT = alternative minimum tax.


Effective Marginal Income Tax Rates, Belarus
married couple with two children
120
100
80
60
40
20
0
0
250
500
750
1,000
1,250
1,500
1,750
2,000
2,250
2,500
Monthly income, thousands BLR

Rest of talk

- 2 period model
- Preferences $-\exp\left(-\psi\left(c+\frac{1}{\gamma}l^{\gamma}\right)\right)$
  - no income effects
  - all types have the same elasticity of labor supply γ
- Utilitarian preference
  - $G(U)=U$
- Suppose all types are drawn each period from distribution $F(\theta)$
  - discuss persistence later in the talk

Dynamic model

- Optimal allocations can be found recursively
  - introduce additional variable $w(\theta)$ - promised utility
- Second period problem unchanged relative to static model
- First period problem:

$$V(w_0) = \min \int (c(\theta) - y(\theta) + \delta V(w(\theta)))dF(\theta)$$

s.t.

$$w_0 = \int (U(c(\theta), y(\theta)/\theta) + \beta w(\theta))\, dF(\theta)$$

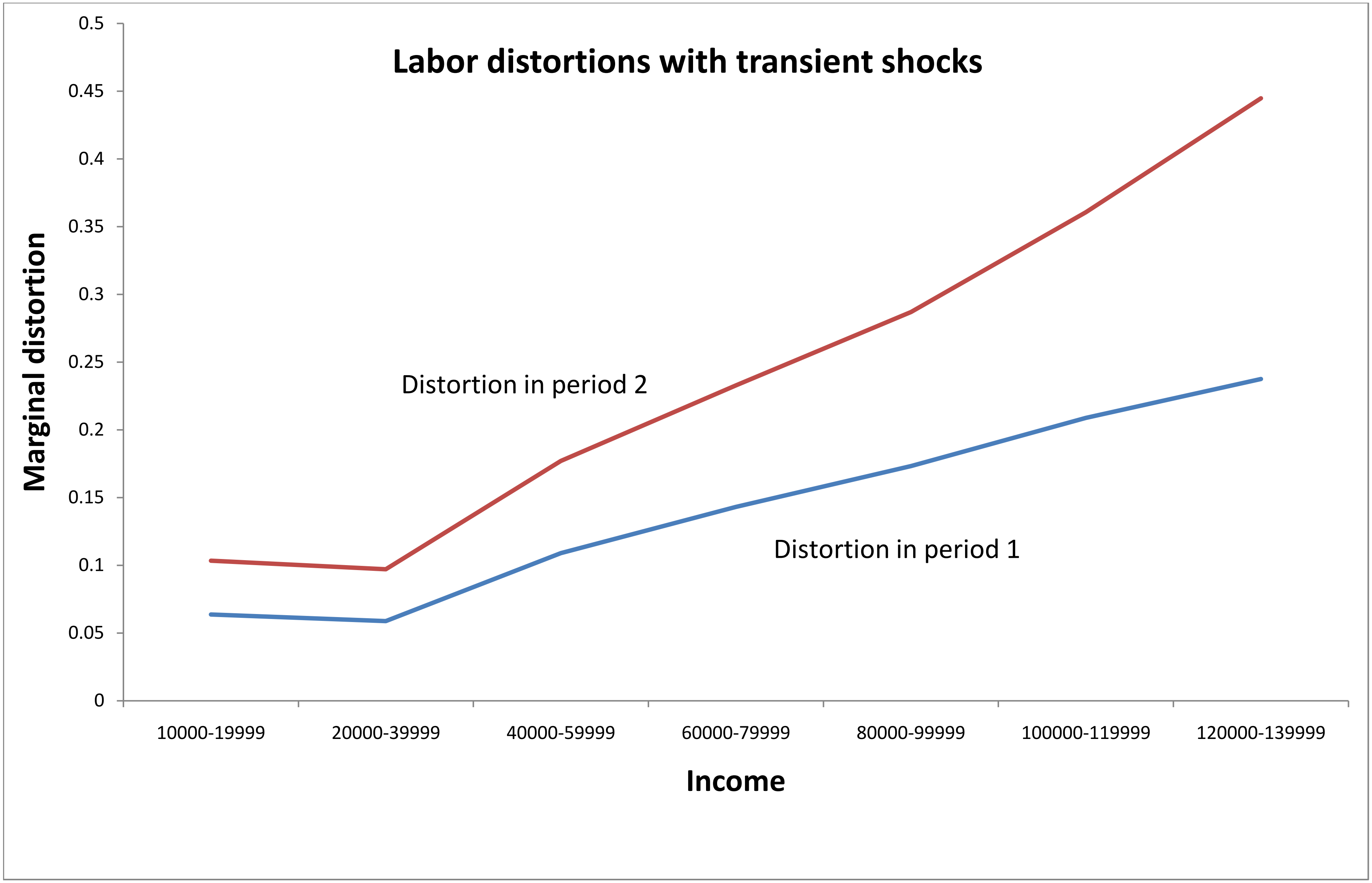
$$U(c(\theta), y(\theta)/\theta) + \beta w(\theta) \geq U(c(\theta'), y(\theta')/\theta) + \beta w(\theta') \quad \text{for all } \theta, \theta'$$

Optimal labor distortions

- Labor distortions in period 2 are the same as in static model
- Labor distortions in period 1:

$$\frac{T_D'(\theta)}{1 - T_D'(\theta)} = \gamma \left(\frac{1 - F(\theta)}{\theta f(\theta)} \right) \left(\int_\theta^\infty \Psi(x) \left(1 - \frac{U(x)}{p} \right) \frac{dF(x)}{1 - F(\theta)} \right)$$

  - $0 < \Psi(x) < 1$, $\Psi(x)$ is decreasing
- Labor distortions are lower in period 1, especially on high types
  - no need to distort as much because can provide incentives in the future



Source: PSID, 1997 wave

Consolidated labor income accounts

- What are the simple practical ways to implement in practice?
- Consolidated labor income account (CIA)
  - Start with ω_0 on CIA
  - If your income is y_t in period t
    - update CIA $\omega_{t+1} = \omega_t(y_t) + \omega_t$
    - deduct current CIA balance from taxes (add to transfers) $T_t(y_t) - \omega_t$
- Optimal labor taxes are *lower* than labor distortions:

$$T'_D(\theta) = T'(y(\theta)) + \zeta\omega'(y(\theta))$$

Persistent shocks

- Idiosyncratic shocks are highly persistent
- Suppose period 1 distribution is $F(\theta)$, distribution in period 2 depends on shock realization in period 1.
- Consider two types in period 1, θ_H or θ_L, "close" to each other
- Conditional distributions in period 2 $F_H(\theta), F_L(\theta)$

Labor distortions

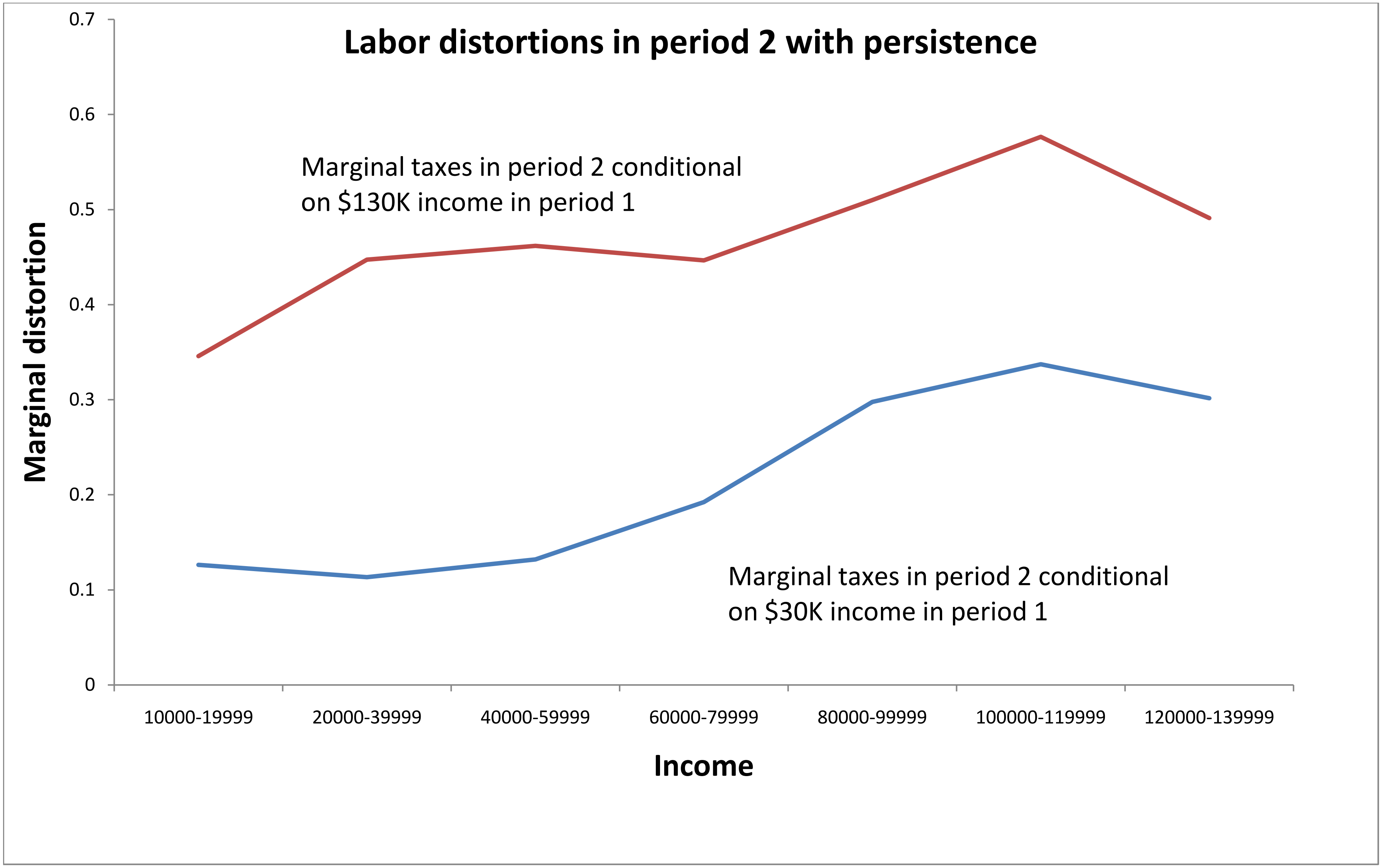
- Insights about labor distortions and taxes in period 1 remain unchanged
- Marginal taxes in period 2 on type that was θ_L in period 1:

$$\frac{T'(\theta|\theta_L)}{1 - T'(\theta|\theta_L)} = \gamma \frac{1 - F_L(\theta)}{\theta f_L(\theta)} \int_\theta^\infty \left(1 - \frac{\frac{1-\lambda \frac{f_H(x)}{f_L(x)}}{1-\lambda} U(x)}{p} \right) \frac{f_L(x)}{1 - F_L(\theta)} dx$$

- Two key additional insights
  - Use conditional distribution F_L instead of unconditional F
  - Use more redistributive Pareto weights $\left(1 - \lambda \frac{f_H(\theta)}{f_L(\theta)}\right) / (1 - \lambda)$ instead of Utilitarian

Intuition

- Marginal taxes in period 2 provide insurance against period 2 shocks
  - depend on distribution of income in period 2 *conditional* on income in period 1
- Since shocks are persistent:
  - low type is likely to remain low in period 2
  - high type who lied in period 1 is likely to be high in period 2
  - more redistribution in period 2 among agents who were low in period 1
    - benefits low types
    - makes it costlier to slack for high types in period 1



Source: PSID, 1997 and 2005 waves

Decentralization with Persistent Shocks

- Main result: there exists a CIA system that implements the optimum with persistent shocks
- Similar to iid case:
  - update CIA $\omega_{t+1} = \omega_t (y_t|\omega_t)$
  - deduct current CIA balance from taxes (add to transfers) $T_t (y_t|\omega_t)$

Summary

Three lessons

- Need for consolidated income accounts
- Lower labor distortions early in lifetime
- The longer an agent has low income, the more redistribution he receives